Federal Aviation Administration – Regulations and Policies
Aviation Rulemaking Advisory Committee

Transport Airplane and Engine Issue Area
Airworthiness Assurance Working Group

Task 3 – Structural Fatigue Evaluation

Task Assignment

ittee of the Aviation
ing Advisory Committee.

THER INFORMATION CONTACT: iam J. (Joe) Sullivan, Executive General Aviation and Business Subcommittee, Aircraft ation Service (AIR-3), 800 dence Avenue, SW., ington, DC 20591, telephone: (202) ; FAX: (202) 267-9562.

ENTARY INFORMATION: The Aviation Administration (FAA) ed an Aviation Rulemaking Committee (56 FR 2190, 22, 1991) which held its first on May 23, 1991 (56 FR 20492, 1991). The General Aviation and Airplane Subcommittee was ed at that meeting to provide and recommendations to the Aircraft Certification Service, regarding the airworthiness for standard and commuter airplanes and engines in part Federal Aviation Regulations, allel provisions of parts 91 and Federal Aviation Regulations. FAA announced at the Joint Authorities (JAA)-Federal Administration (FAA) ization Conference in Toronto, Canada, (June 2-5, 1992) that it consolidate within the Aviation king Advisory Committee re an ongoing objective to nize" the Joint Aviation ments (JAR) and the Federal Regulations (FAR). Coincident that announcement, the FAA ed to the General Aviation and Airplane Subcommittee those king projects related to JAR/FAR Harmonization which were then in process of being coordinated the JAA and the FAA. The ization process included the tion to present the results of JAA/ FAA coordination to the public in the of a Notice of Proposed king—an objective comparable and compatible with that assigned to Aviation Rulemaking Advisory ittee. The General Aviation and Airplane Subcommittee, quently, established the JAR/FAR Harmonization Working Group. ifically, the Working Group's are the following: The JAR/FAR 23 nization Working Group is ed with making recommendations the General Aviation and Business Subcommittee concerning the disposition of the following king subjects recently inated between the JAA and the

Task 1 Review JAR Issues: Review 23 Issue No. 4 (which excludes commuter category airplanes) and No. 5 (which includes commuter category airplanes), and compare them with Amendment 23-42 to FAR 23, and the proposals in Notices 3 and 4 from the Part 23 Airworthiness Review. Identify technical differences between JAR 23 and FAR 23 which can be harmonized.

Task 2-Systems and Equipment: Based on the results of the Task 1 review, identify the changes to Subparts D and F of FAR 23 that are appropriate for harmonization, and those provisions that should not be harmonized, if any.

Task 3-Powerplant: Based on the results of the Task 1 review, identify the changes to Subpart E of FAR 23 that are appropriate for harmonization, and those provisions that should not be harmonized, if any.

Task 4-Flight Test: Based on the results of the Task 1 review, identify the changes to Subparts A, B and G of FAR 23 that are appropriate for harmonization, and those provisions that should not be harmonized, if any.

Task 5-Airframe: Based on the results of the Task 1 review, identify the changes to Subparts C and D of FAR 23 that are appropriate for harmonization, and those provisions that should not be harmonized, if any.

Reports

A. Recommend time line(s) for completion of each task, including rationale, for Subcommittee consideration at the meeting of the subcommittee held following publication of this notice.

B. Give a detailed presentation to the subcommittee of the results of Task 1 before proceeding with Tasks 2-5.

C. Give a detailed conceptual presentation on Tasks 2-5 to the Subcommittee before proceeding with the work stated under item D, below. Each presentation should identify what proposed amendments will be included in each notice, and whether any additional notices will be need to be drafted in addition to the four identified in item D, below. These reports may be combined or presented separately at the discretion of the working group chair.

D. Draft a separate Notice of Proposed Rulemaking for Tasks 2-5 proposing new or revised requirements, a supporting economic analysis, and other required analysis, with any other collateral documents (such as Advisory Circulars) the Working Group determines to be needed.

E. Give a status report on each task at each meeting of the Subcommittee.

The JAR/FAR 23 Harmonization Working Group will be comprised of experts from those organizations having an interest in the task assigned to it. A working group member need not necessarily be a representative of one of the organizations of the parent General Aviation and Business Airplane Subcommittee or of the full Aviation Rulemaking Advisory Committee. An individual who has expertise in the subject matter and wishes to become a member of the working group should *write* the person listed under the caption "FOR FURTHER INFORMATION CONTACT" expressing that desire, describing his or her interest in the task, and the expertise he or she would bring to the working group. The request will be reviewed with the subcommittee chair and working group leader, and the individual advised whether or not the request can be accommodated.

The Secretary of Transportation has determined that the information and use of the Aviation Rulemaking Advisory Committee and its subcommittees are necessary in the public interest in connection with the performance of duties imposed on the FAA by law. Meetings of the full committee and any subcommittees will be open to the public except as authorized by section 10(d) of the Federal Advisory Committee Act. Meetings of the JAR/FAR 23 Harmonization Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on November 19, 1992.

William J. Sullivan,

Executive Director, General Aviation and Business Airplane Subcommittee, Aviation Rulemaking Advisory Committee.

[FR Doc. 92-28931 Filed 11-27-92; 8:45 am]

BILLING CODE 4910-13-M

Aviation Rulemaking Advisory Committee; Transport Airplane and Engine Subcommittee; Airworthiness Assurance Working Group

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of establishment of the airworthiness assurance working group.

SUMMARY: Notice is given of the establishment of an Airworthiness Assurance Working Group by the Transport Airplane and Engine Subcommittee.

FOR FURTHER INFORMATION CONTACT: Mr. William J. (Joe) Sullivan, Executive Director, Transport Airplane and Engine Subcommittee, Aircraft Certification Service (AIR-3), 800 Independence Avenue, SW., Washington, DC 20591,

Telephone: (202) 267–9554; FAX: (202) 267–5364.

SUPPLEMENTARY INFORMATION: The Federal Aviation Administration (FAA) established an Aviation Rulemaking Advisory Committee (ARAC) (56 FR 2190, January 22, 1991) which held its first meeting on May 23, 1991 (56 FR 20492, May 3, 1991). The Transport Airplane and Engine Subcommittee was established at that meeting to provide advice and recommendations to the Director, Aircraft Certification Service, FAA, regarding the airworthiness standards for transport category airplanes and engines in parts 25, 33 and 35 of the Federal Aviation Regulations (14 CFR parts 25, 33, 35).

Before the establishment of the Aviation Rulemaking Advisory Committee, the agency's Research, Engineering, and Development Advisory Committee established a Transport Airplane Safety Subcommittee. In turn that subcommittee established the Airworthiness Assurance Task Force to deal with issues arising out of the tragic aircraft accident in Hawaii involving an Aloha Airlines B–737. The ARAC Transport Airplane and Engine Subcommittee was tasked with assuming jurisdiction over the Airworthiness Assurance Task Force. This was accomplished, and this notice renames the Task Force as the Airworthiness Assurance Working Group and restates its tasks.

Specifically, the Airworthiness Assurance Working Group's tasks are:

Task 1-Corrosion: Develop recommendations concerning whether new or revised requirements and compliance methods for corrosion prevention and control programs should be instituted and made mandatory for the Airbus A–300, British Aerospace BAC 1–11, Boeing B–707, B–727, B–737, B–747, Douglas DC–8, DC–9/MD–80, DC–10, Fokker F–28, and Lockheed L–1011.

Task 2-Repairs: Develop recommendations concerning whether new or revised requirements and compliance methods for structural repair assessments of existing repairs should be instituted and made mandatory for the Airbus A–300, British Aerospace BAC 1–11, Boeing B–707, B–727, B–737, B–747, Douglas DC–8, DC–9/MD–80, DC–10, Fokker F–28, and Lockheed L–1011.

Task 3-Structural Fatigue Audit: Develop recommendations on whether new or revised requirements for structural fatigue evaluation and corrective action should be instituted and made mandatory as the airplane ages past its original design life goal.

Task 4-Supplemental Structural Inspection Programs: Conduct a review of existing supplemental structural inspection programs to determine whether any new or revised requirements should be instituted and made mandatory as the airplane ages past its original design life goal. This review should cover the following airplanes: Airbus A–300, British Aerospace BAC 1–11, Boeing B–707, B–727, B–737, B–747, Douglas DC–8, DC–9/MD–80, DC–10, Fokker F–28, and Lockheed L–1011.

Reports

A. Recommend time line(s) for completion of each task, including rationale, for Subcommittee consideration at the meeting of the subcommittee held after the publication of this notice.

B. Give a detailed conceptual presentation to the Subcommittee, and receive it's concurrence, before proceeding with the work stated under item D, below.

C. Draft a Notice of Proposed Rulemaking proposing requested or modified new or revised requirements, a supporting economic, and other required analysis, with any other collateral documents the Working Group determines to be needed.

D. Give a status report on each task at each meeting of the Subcommittee.

The Airworthiness Assurance Working Group will be comprised of experts from those organizations having an interest in the task assigned to it. A working group member need not necessarily be a representative of one of the organizations of the parent Transport Airplane and Engine Subcommittee or of the full Aviation Rulemaking Advisory Committee. An individual who has expertise in the subject matter and wishes to become a member of the working group should write the person listed under the caption **FOR FURTHER INFORMATION CONTACT** expressing that desire, describing his or her interest in the task, and the expertise he or she would bring to the working group. The request will be reviewed with the subcommittee chair and working group leader, and the individual advised whether or not the request can be accommodated.

The Secretary of Transportation has determined that the information and use of the Aviation Rulemaking Advisory Committee and its subcommittees are necessary in the public interest in connection with the performance of duties imposed on the FAA by law. Meetings of the full committee and any subcommittees will be open to the public except as authorized by section 10(d) of the Federal Advisory Committee Act. Meetings of the Airworthiness Assurance Working Group will not be open to the public, except to the extent that individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on November 19, 1992.

William J. Sullivan,

Executive Director, Transport Airplane and Engine Subcommittee, Aviation Rulemaking Advisory Committee.

[FR Doc. 92–28936 Filed 11–27–92; 8:45 am]

BILLING CODE 4910–13–M

Aviation Rulemaking Advisory Committee; Transport Airplane and Engine Subcommittee; Small Transport and Commuter Airworthiness Assurance Working Group

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of establishment of the small transport and commuter airworthiness assurance working group.

SUMMARY: Notice is given of the establishment of a Small Transport and Commuter Airworthiness Assurance Working Group by the Transport Airplane and Engine Subcommittee.

DATES: William J. (Joe) Sullivan, Executive Director, Transport Airplane and Engine Subcommittee, Aircraft Certification Service (AIR–3), 800 Independence Avenue, SW., Washington, DC 20591, Telephone: (202) 267–9954; FAX: (202) 267–5364.

SUPPLEMENTARY INFORMATION: The Federal Aviation Administration (FAA) established an Aviation Rulemaking Advisory Committee (ARAC) (56 FR 2190, January 22, 1991 (which held its first meeting on May 23, 1991 (56 FR May 3, 1991). The Transport Airplane and Engine Subcommittee was established at that meeting to provide advice and recommendations to the Director, Aircraft Certification Service, FAA, regarding the airworthiness standard for transport category airplanes, engines, and propellers in parts 25, 33 and 35 of the Federal Aviation Regulations (14 CFR parts 25, 33, 35).

Before the establishment of the Aviation Rulemaking Advisory Committee, the agency's Research, Engineering, and Development Advisory Committee established a Transport Airplane Safety Subcommittee. In turn that subcommittee established the Airworthiness Assurance Task Force

Recommendation Letter

Boeing Commercial Airplane Group
P.O. Box 3707
Seattle, WA 98124-2207

Jean

#3

July 14, 1994
B-T01B-GRM-94-048

Mr. Anthony J. Broderick
Associate Administrator for Regulations and Certification, (AVR-1)
Department of Transportation
Federal Aviation Administration
800 Independence Avenue, S.W.
Washington DC 20591
Tele: (202) 267-3131
Fax: (202) 267-5364

BOEING

Dear Mr. Broderick:

On behalf of the Aviation Rulemaking Advisory Committee, I am pleased to submit the enclosed proposed amendment to FAR Advisory Circular 91-56 on the following subject:

Structural Fatigue Evaluation for Aging Airplanes

The enclosed package is in the form of a final report. The package was developed by the Airworthiness Assurance Working Group chaired by Ronald Wickens of Federal Express. The membership of the group is a good balance of interested parties in the U.S. and Europe. This group can be available if needed for docket review.

The members of ARAC appreciate the opportunity to participate in the FAA rulemaking process and fully endorse this recommendation.

Sincerely,

Gerald R. Mack
Assistant Chairman
Transport Airplane & Engine Issues Group
Aviation Rulemaking Advisory Committee
Tele: (206) 234-9570, Fax: 237-0192, Mailstop: 67-UM

Enclosure

cc: M. Borfitz (617) 238-7199
S. Miller (206) 227-1100
R. Wickens (901) 369-3913

Acknowledgement Letter

AUG 16 1994

Mr. Gerald R. Mack
Aviation Rulemaking Advisory Committee
Boeing Commercial Airplane Group
P.O. Box 3707
Seattle, WA 98124-2207

Dear Mr. Mack:

Thank you for your July 14 letter forwarding the Aviation Rulemaking Advisory Committee's (ARAC) recommendation to amend Advisory Circular 91-56, Structural Fatigue Evaluation for Aging Airplanes.

I would like to thank the aviation community for its commitment to ARAC and its expenditure of resources to develop the recommendation. We in the Federal Aviation Administration (FAA) pledge to process the document expeditiously as a high-priority action.

Again, let me thank the ARAC and, in particular, the Airworthiness Assurance Working Group for its dedicated efforts in completing the task assigned by the FAA.

Sincerely,

Anthony J. Broderick
Associate Administrator for
Regulation and Certification

Recommendation

A REPORT OF THE AIRWORTHINESS ASSURANCE WORKING GROUP

STRUCTURAL FATIGUE EVALUATION FOR AGING AIRPLANES

FINAL REPORT

OCTOBER 1993

SIGNED BY

RONALD WICKENS
CHAIRMAN AAWG

4.0 PROPOSED AMENDMENT TO AC 91-56

The following is a proposed amendment to FAR Advisory Circular 91-56. It is proposed that the text of this section be added to AC 91-56 as Appendix 3. A description of the basic problem and proposed structural evaluation is contained in Appendix H of this report.

FAR ADVISORY CIRCULAR 91-56
PROPOSED APPENDIX 3

1. PURPOSE

a. The purpose of this appendix is to provide rational guidelines to evaluate airplane structure for the potential occurrence of widespread damage with service use beyond the original design service goal. While the initial AC addressed damage at multiple sites it has not focused specifically on the widespread damage (both Multiple Site Damage (MSD) and Multiple Element Damage (MED)) phenomenon. This phenomenon, in the absence of highly reliable small damage detection techniques, could lead to unrecognized reductions in structural strength below the damage tolerance safety requirements.

b. The guidelines in this appendix will facilitate a reasonable prediction of where, how and when widespread damage may occur, means to assess the effectiveness of existing or candidate supplemental inspections, and the desirability of specific preventative modifications in the fleet. Further, they will promote commonalty across all models of all manufacturers, with a consequent better universal focus throughout the industry.

c. Since a few cracks of a size which may not be reliably detected by NDT can cause unacceptable reduction in residual strength, no widespread damage should be allowed to occur within the original or extended design service goal of an airplane.

2. BACKGROUND

a. Since August of 1988, the aviation industry (manufacturers, operators and regulatory agencies), has been fully engaged in developing measures to ensure the safety with extended service of aging airplanes. At the direction of the FAA, an Airworthiness Assurance Task Force (AATF), now known as the Airworthiness Assurance Working Group (AAWG) was formed from members of ATA, IATA, AIA, AECMA, FAA and JAA. The group promulgated programs to require: 1) specific mandatory structural modifications, 2) comprehensive corrosion prevention and control actions, 3) continuing updates to the SSIP, and 4) generic and specific maintenance guidelines for each model. A fifth program to assess the quality of repairs is in the final stages.

b. Notwithstanding these actions which supplement on the basic ongoing maintenance programs, there is still concern for the safety implications of possible WFD with increasing age. Consequently, the AAWG proposes that a comprehensive evaluation for potential WFD be conducted for aging airplane models when or before the fleet leaders of each model reach their design service goals. The guidelines in this Appendix will aid these evaluations by providing a common focus and approach.

3. INTRODUCTION

a. The likelihood of the occurrence of fatigue damage in an airplane's structure increases with the number of repeat load cycles that the airplane experiences. During the design process the manufacturer selects a design service goal in terms of flight cycles/hours for the airframe. The manufacturer strives to keep the probability of cracking to a minimum up to the design service goal. It is expected that any cracking that occurs during this period will occur in isolation, originating from a single source, such as a random manufacturing flaw (e.g., a mis-drilled fastener hole). Because the manufacturing flaws are randomly distributed throughout the structure, it is considered unlikely that they will result in cracks that will interact strongly as they grow. The fail-safe or damage tolerant character of most modern airplane structure, together with competent airline maintenance practices and the regulatory airworthiness system, has established an excellent safety record with regard to such random damage.

b. Nevertheless, at a certain age, uniformly loaded structure may develop cracks in adjacent fasteners, or in adjacent similar structural details, which interact to reduce the damage tolerance of the structure in a manner which may not be readily detectable. The methods used to date to develop structural inspection programs have generally considered only localized interactions between fatigue cracks. In retrospect, such inspection programs are only valid before WFD occurs.

c. The development of cracks at multiple locations, (both multiple-site and multiple-element) may result in strong interactions that can affect predictions of growth and fracture, in which case the predictions for local cracking may no longer apply. An example of this situation may occur at a fuselage skin lap joint. Simultaneous cracking at many fasteners along a common rivet line may reduce the damage tolerance of the joint below required levels before the cracks are readily detectable during routine maintenance.

d. The occurrence of corrosion, or other structural degradation can couple with fatigue cracking and reduce the effectiveness of an airplane's routine structural maintenance program.

e. Unless there is a high confidence in the ability to detect and rectify WFD in its early subcritical stages, continued safe operation of the airplane is in doubt. Therefore it is necessary to conduct an objective evaluation to determine where and when WFD may occur and take appropriate action in the aging fleets to preclude it.

f. The process to be followed in conducting the WFD evaluation is outlined in Figure 1. The various means to implement the evaluation are shown in Figure 2.

4. DEFINITIONS

a. Damage tolerance is the attribute of a structure that permits it to retain its required residual strength for a period of usage after the structure has sustained specific levels of fatigue, corrosion, accidental or discrete source damage.

b. Design service goal is the period of time (in flight cycles/hours)established at design and/or certification during which the principal structure will be reasonably free from significant cracking.

c. Widespread Fatigue Damage (WFD) in a structure is characterized by the simultaneous presence of cracks at multiple structural details that are of sufficient size and density whereby the structure will no longer meet its damage tolerance requirement.

(1). Multiple Site Damage (MSD) is a source of WFD characterized by the simultaneous presence of fatigue cracks in the same structural element (e.g. fatigue cracks that may coalesce with or without other damage leading to a loss of required residual strength.

(2). Multiple Element Damage (MED) is a source of WFD characterized by the simultaneous presence of fatigue cracks in similar adjacent structural elements

5. STRUCTURAL EVALUATION.

a. General. The evaluation has three objectives:

(1) Identify primary structure susceptible to WFD
(see Paragraph 5.b (1) and 5.b (2)).

(2) Predict when it is likely to occur.
(see Paragraph 5.c)

(3) Establish additional maintenance actions, as necessary, to ensure continued safe operation.
(see Paragraph 5.d)

b. Structure Susceptible to WFD. Susceptible structure is defined as that which has the potential to develop WFD. Such structure typically has the characteristics of similar details operating at similar stresses where structural capability could be affected by interaction of similar cracking. The generic types of susceptible structure are listed below {see Section 5.0, Appendix(D)}:

(1) Fuselage

(i) Longitudinal Skin Joints, Frames, and Tear Straps (MSD, MED);

(ii) Circumferential Joints and Stringers (MSD, MED);

(iii) Fuselage Frames (MED);

(iv) Aft Pressure Dome Outer Ring and Dome Web Splices (MSD, MED);

(v) Other Pressure Bulkhead Attachment to Skin - Web Attachment to Stiffener and Pressure Decks (MSD, MED);

(vi) Stringer to Frame Attachments (MED);

(vii) Window Surround Structure (MSD, MED);

(viii) Over Wing Fuselage Attachments (MED);

(ix) Latches and Hinges of Nonplug Doors (MSD, MED);

(x) Skin at Runout of Large Doubler (MSD);

(2) Wing and Empennage

(i) Skin at Runout of Large Doubler (MSD);

(ii) Chordwise Splices (MSD, MED);

(iii) Rib to Skin Attachments (MSD, MED);

(iv) Stringer Runout at Tank End Ribs (MED, MSD).

c. Determination of WFD. The time in terms of hours and/or flights to the occurrence of WFD should be established. The structural condition which constitutes WFD should be determined for each area of the airframe on each model where the simultaneous presence of sub-critical fatigue cracks at multiple sites is likely to cause interactive accelerated crack growth and/or a degradation of the residual strength capability. The evaluation should include a complete review of the service history of the susceptible areas, relevant full-scale and component fatigue test data, teardown inspections, and any fractographic analysis available. The evaluation of test results for the reliable prediction of the time WFD occurs for each susceptible area should include appropriate test-to-structure factors and a scatter factor {see Section 6.0 Appendix D}. Risk analysis may also be used, when appropriate, to predict when WFD will occur.

(1). Each susceptible area should be evaluated to establish the size and extent of multiple cracking that could cause the residual strength to degrade below required levels.

(2). Each susceptible area should be evaluated for a discrete source damage event due to uncontained failure of engines, fan blades and high energy rotation machinery, unless it has been demonstrated that the risk due to such an event does not exceed an acceptable level.

(3). Each susceptible area should be evaluated to establish the time WFD is expected to occur.

(i). This initial estimate may be analytically determined, supported by existing test or service evidence.

(ii). Reestimates of the time of WFD occurrence should be made based on additional information from the continuing assessment of the fleet demonstrated capability and one or more of the following:

(a) Additional fatigue and/or residual strength tests on a full-scale airplane structure or a full-scale component, followed by detailed inspections and analyses.

(b) Testing of new or used structure on a smaller scale than full component tests, i.e. sub-component and/or panel tests.

(c) Tear-down inspections (destructive) that could be done on structural components that have been removed from service.

(d) Local teardown by selected, limited (non-destructive) disassembly and refurbishment of specific areas of high-time airplanes.

d. Maintenance Programs.

(1). Maintenance/Inspection Programs Before Estimated WFD Occurs. For all areas that have been identified as susceptible to WFD, the current maintenance program should be evaluated to determine if adequate structural maintenance and inspection programs exist to safeguard the structure against unanticipated cracking or other structural degradation before the estimated occurrence. The assessment of these inspections should typically be done in the following steps:

(i). Determine the level (inspection threshold, repeat interval, methods, and area) of the inspection for each susceptible area that is necessary to maintain the required level of safety.

(ii). Review the existing maintenance programs, including the AATF/AAWG initiatives, to determine whether they provide the required level of safety.

(iii) Develop and recommend to the FAA supplemental inspections for areas where the existing maintenance programs are not adequate.

(2). Actions Required At The Estimated Occurrence Of WFD. For airplanes reaching the estimated occurrence of WFD, a program should be developed and recommended to the FAA that either:

(i). Provides for an in-depth inspection program that will achieve the required detection reliability to preclude a reduction of the residual strength below the required level; or

(ii). Replaces or modifies the susceptible structural area.

e. Period of Evaluation Validity. The initial evaluation of the complete airframe should cover a significant forward projection of airplane usage beyond the design service goal. Typically an assessment through at least an additional twenty-five percent of the design service goal would provide a realistic forecast with reasonable planning time for necessary maintenance action.

However it may be appropriate to vary the evaluation validity period depending on issues such as:

(1). Projected useful life of the airplane at the time of the initial evaluation (could increase or decrease the validity period).

(2). Expectations of improved NDI technology (could decrease the initial validity period, pending new methods becoming available).

(3). Airline advance planning requirements for introduction of new maintenance and modification programs.

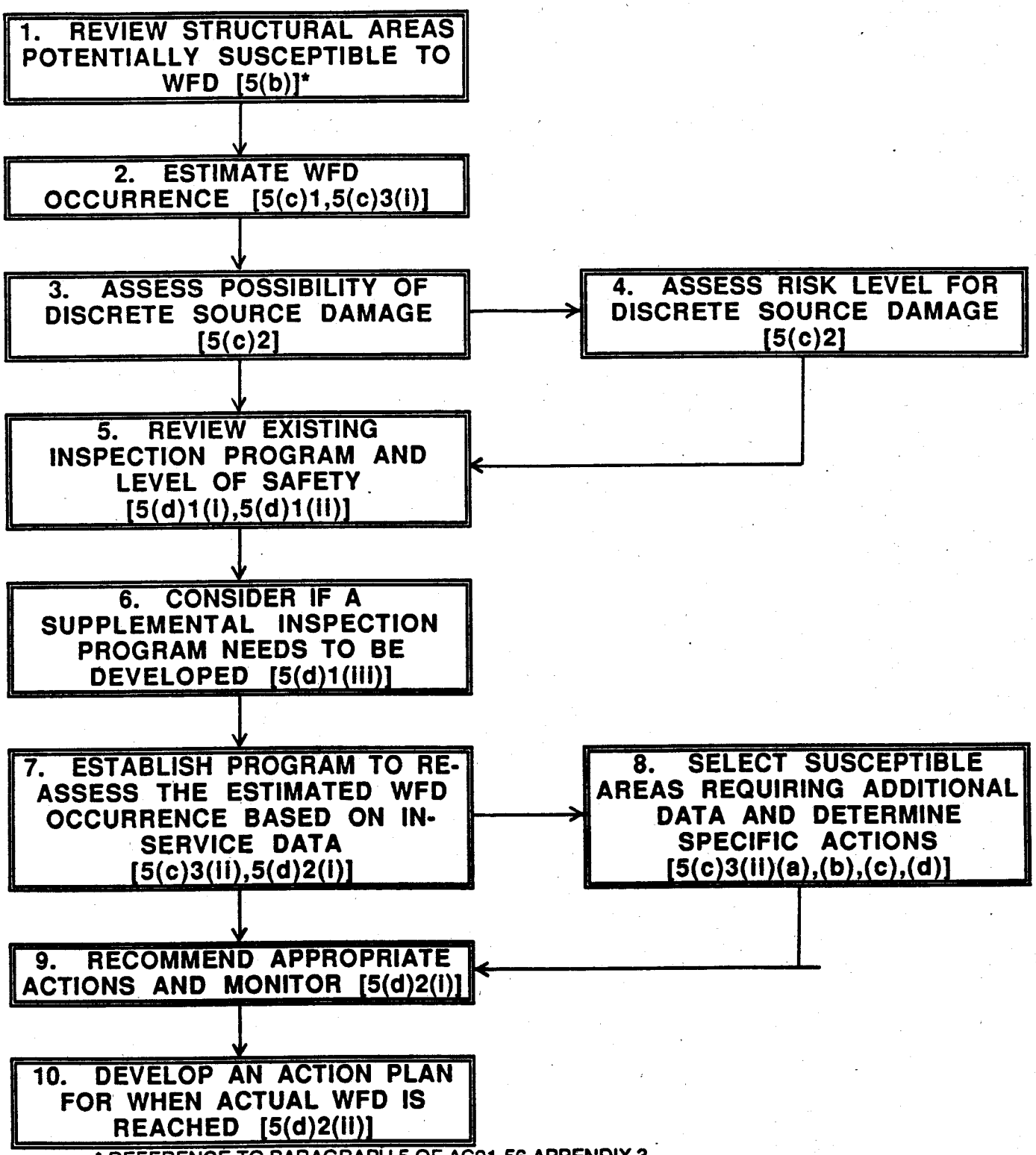
(4). Providing sufficient forward projection to identify all likely maintenance/modifications actions essentially as one package.

Subsequent evaluations should follow similar validity period guidelines as the initial evaluation.

6. RESPONSIBILITY.

It is expected that the evaluation will be conducted in a cooperative effort between the operators and manufacturers with participation by regulatory representatives during the evaluation.

FIGURE 1 AIRPLANE EVALUATION PROCESS



* REFERENCE TO PARAGRAPH 5 OF AC91-56 APPENDIX 3

FIGURE 2 ELEMENTS OF THE STRUCTURAL EVALUATION

ELEMENTS OF THE STRUCTURAL EVALUATION FOR THE 11 AAWG MODELS	PRIME RESP	SEC RESP	DOCUMENTATION
1. For each model determine the area susceptible to Widespread Fatigue Damage (MSD or MED).	M	R,O	AC 91-56 AP 3
2. For each area establish WFD parameters.	M	R,O	AC 91-56 AP 3
3. Determine concern for discrete source damage.	M	R,O	AC 91-56 AP 3
4. Assess risk level for discrete source damage.	M	R,O	AC 91-56 AP 3
5. Review existing inspection programs & level of safety. 5.1 Determine required level of inspection. 5.2 Review existing maintenance programs. 5.3 Evaluate possibility of opportunistic inspections.	 M O O,M	 R,O M,R R	 AC 91-56 AP 3 AC 91-56 AP 3 AC 91-56 AP 3
6. Consider if a supplemental inspection program needs to be developed.	O,M,R		SSIP or SB/AD
7. Establish program to re-assess the estimated WFD occurrence based on in-service data.	O,M	R	SSIP or SB/AD
8. Select susceptible areas requiring additional data and determine specific actions. 8.1 Additional fatigue test (full scale). 8.2 Tear down inspection (destructive). 8.3 Component test. 8.4 Local tear down and refurbishment. 8.5 Assessment of fleet demonstrated capability.	M M M M M,O M,O		AC 91-56 AP 3
9. Recommend appropriate actions and monitor.	M,O	R	AC 91-56 AP 3
10. Develop an action plan for when the actual WFD is determined. 10.1 Modify the affected structure. 10.2 Replace the affected structure	M,R,O M,O M,O		SB/AD

M - MANUFACTURER R - REGULATOR O - OPERATOR

APPENDIX H WFD ISSUES

A. VIEW OF THE PROBLEM

The major issue is the loss of the required residual strength capability existing at type certification due to either multiple site damage (MSD) or multiple element damage (MED) containing sub critical cracks in the event of:

- Unstable propagation of one or more of these cracks, or
- Unstable propagation of a rogue manufacturing or service induced flaw, or
- Impact damage from a discrete external source of a size either equal to or less than the design damage size.

The effect of WFD on residual strength, e.g. the combination of a large crack (by itself sub critical) with adjacent small cracks can result in reduction in residual strength as verified by several tests with wing and fuselage panels. Even small flaws (e.g. a few hundredths of an inch) which may not be detectable by NDT without fastener removal may degrade the residual strength below the required level. Consequently the prediction of the occurrence of WFD comprises three problems:

- Determination of the nature and extent of primary damage
- Determination of the sizes of cracks adjacent to the primary damage that will degrade the residual strength below the required level
- Determination of the point in time (flights) when such damage of this size and density will occur.

Since a few cracks of a size which may not be reliably detected by NDT with or without fastener removal can cause unacceptable reduction in residual strength, no widespread damage should be allowed to occur within the original or extended design service goal of an airplane.

The scenario above represents the specific case for material splices. Design details for splices dictate usually small distances between fatigue initiation sites (fastener holes). For other areas, where more distance exist between initiation sites, the effect of MSD on residual strength may be less pronounced.

B. STRUCTURAL EVALUATION

The structural evaluation to identify primary structure susceptible to WFD, to predict the time of occurrence and to establish necessary additional maintenance actions for ensuring continued safe operation is described in Section 4, Paragraph 5.

The structural evaluation considers all susceptible structure which has the potential to develop WFD. For example cracks initiated by fatigue in a MSD or MED regime may degrade the residual strength below its required level.

In addition, each susceptible area should be evaluated for a discrete source damage event due to uncontained failure of engines, fan blades and high energy rotating machinery, unless it has been demonstrated that the risk of such an event does not exceed an acceptable level.

According to present experience the combination of cracks due to accidental damage (non in-flight event - service induced flaw) with adjacent small cracks can be shown to be an unlikely event. Small cracks due to accidental damage adjacent to small MSD cracks will not degrade the residual strength below the required level and will be detected during the next routine inspections. Longer cracks due to accidental damage are more readily detectable and normally will be detected and repaired before next flight. The probability of in-flight events such as lightning strike, hail etc. causing significant damage in areas susceptible to WFD is very low and the damage will be detected during routine inspections.

A single crack resulting from a rogue manufacturing flaw will either be detected and repaired before the occurrence of WFD or will be detected before reaching an unacceptable length during the monitoring period with repetitive inspections, i. e. between fatigue crack initiation and the occurrence of WFD. Other damage such as, scribe marks, dents from tools etc., are addressed as part of the quality assurance process in place as part of the manufacture / maintenance process.

FAA Action – Not Available